ON THE ORGAN OF JACOBSON IN AN AUSTRALIAN BAT *(MINIOPTERUS)*.

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(Plate xlvii.)

In the course of a recent investigation of certain details in the comparative anatomy of Jacobson's Organ, the results of which I have embodied in a thesis recently presented to Glasgow University, I discovered in the common little Australian bat, besides a number of other interesting points, a well-developed organ of Jacobson.

Jacobson's Organ, as is well known, is found in the large majority of Mammals—from the Monotremata, where it is greatly developed, to man, where it is rudimentary. In the majority of orders it is typically present, but in the higher forms it is frequently absent. Herzfeld,* who has examined a very considerable variety of animals, found it quite absent in two Old World Monkeys, *Cercopithecus* and *Inuus*, though present in the New World genus, *Hapale*, and also in the Lemur. Among the *Chiroptera* he found the organ to be absent in the flying-fox *(Pteropus edwardsi)*, and also absent in a native (German) bat, of which unfortunately the species was not determined. From these observations it has naturally been concluded that the organ is absent in the order *Chiroptera*.

Since giving notice of the present communication, and on the eve of sending it off, Dr. Elliott Smith, has kindly called my attention to a paper just recently published on the Organ of Jacobson in the *Chiroptera* by Mm. Duval and Garnault†. In

* P. Herzfeld, "Ueber das Jacobson'sche Organ des Menschen and der Saügethiere." Zool. Jahrb. 1889.

† M. Duval and P. Garnault, "L'organe de Jacobson des Chiroptères"; Compt. Rend. Hebd. des Séances de la Société de Biologie, x. Ser. 28 June, 1895.

this paper the authors call attention to the fact that the organ is not invariably absent in the order, and comment on the curious fact that though the organ is quite absent in *Vespertilio murinus* and *Rhinolophus ferrum-equinum*, in another insectivorous bat, *Vesperugo pipistrellus* there is a moderately developed organ. They do not, however, appear to have made any study of the peculiarities of the organ.

In the common Australian bat which I have studied (*Miniopterus schreibersii*, Natt.) the organ is not only present, but is unusually well-developed; and furthermore it presents certain features which distinguish it from the ordinary mammalian type.

In my recent thesis have been recognised in the Placental Mammals and Marsupials at least three types of Jacobson's Organ, and of the third type two well marked varieties. In the Marsupialia we have a simple generalised type which is moderately closely related to Monotreme type as found in *Echidna*. The organ in Rodents, on the other hand, is peculiarly specialised in opening into the nasal cavity and not into Stenson's duct, though in other respects it comes near to the Marsupial type. In all the other orders of Mammals in which the organ has been examined, so far as I am aware, a third type is followed. Here the organ opens into Stenson's canal as in Marsupials, but the canal is greatly developed in length and passes forwards, becoming merged with Jacobson's duct. There is further a precurrent process of Jacobson's cartilage on the inside of Jacobson's duct, and a similar process on the outer side of Stenson's duct. These, on passing forward, unite above and form a common cartilage for the common duct. This is the type of the Dog, Cat, Sheep, &c. In the bat we have a variety of this type. The cartilages and ducts are arranged in a somewhat similar way, but there is an absence of the great elongation of the ducts, which in their mode of connection with the nasal cavity, and with Jacobson's Organ, present a much nearer approach to the simple Marsupial type.

In *Miniopterus*, though the premaxillaries are fairly well developed, they do not meet in the middle line, a condition

differing considerably from the normal mammalian type. In the middle line is a well developed papilla, supported as I have elsewhere* shown by a development of the prenasal cartilage. A section through the middle of the papilla shows on either side a wide Stenson's duct, which at its upper part is roofed over and protected at the sides by the anterior developments of Stenson's and Jacobson's cartilages. Above this is found the curved cartilage of the nasal floor.

A short distance behind this plane, in a manner similar to that figured by Herzfeld† in the Lemur, the cartilage of the nasal floor becomes divided into an inner and an outer part, as does also the arched cartilaginous roof of Stenson's duct. The two inner parts unite to form Jacobson's cartilage proper; and the outer to form the hinder part of Stenson's cartilage. This is the condition shown in fig. 1. At the inner side of the upper part of Stenson's duct it is found receiving the duct of Jacobson.

Almost immediately behind this Stenson's duct is found opening into the nasal cavity (fig. 2). Here Jacobson's duct is small, and lined with squamous epithelium. On this plane there is no ossification in the neighbourhood of the septum, but a very short distance beyond brings us to a plane cutting the anterior part of the prevomer (fig. 3, *P.vo.*). In a recent paper read before this Society‡ I called attention to this remarkable bone in discussing the homologies of the palatine process of the premaxillary. It is well illustrated in figs. 4 and 5—the former representing an anterior section; the latter a section near its posterior part.

On approaching the region of the prevomer, Jacobson's Organ gradually becomes greatly developed, attaining its maximum near the posterior part of the prevomer. In this region the cartilage of Jacobson forms an almost complete tube, only open slightly on

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* Proc. Linn. Soc. N.S.W. 2nd Ser. Vol. x. pt. 4, 1895.

† *L.c.*

‡ Proc. Linn. Soc. N.S.W. 2nd Ser. Vol. x. pt. 3, 1895.

the outer side. Both the upper and lower ends curve inwards slightly and suggesting the formation of a rudimentary turbinal. The organ itself on section is found to have the usual mammalian shape, though here the regular kidney-shape is slightly distorted, assuming more the Marsupial pattern. The inner wall is composed of the usual neurepithelium, the epithelial cells apparently having short cilia. The outer wall has epithelium with long cilia. A single small blood vessel runs parallel to the organ along the hollow of the outer wall—a feeble representative of the large vascular plexuses of *Echidna* and *Ornithorhynchus*, or even of the rabbit. Of mucous glands there are apparently none within the cartilaginous capsule, and no very abundant supply outside. A number of the septal glands towards the posterior part of the organ appear to supply it with fluid. The organ ends very abruptly.

Stenson's cartilage is well developed, and passes inwards beneath the capsule of Jacobson, somewhat resembling the condition in *Echidna*.

In conclusion the type of organ appears to be intermediate between that of the Marsupial and that of the Carnivore, though more nearly allied to the latter. As regards the relative size of the capsule of Jacobson, it is larger than in any other mammal I know of, even larger than in *Ornithorhynchus* proportionally; in the larger animal, however, owing to the relatively smaller size of the cells, there must be a very much larger number of nerve elements.

I must acknowledge my indebtedness to Messrs. Etheridge and Waite, of the Australian Museum, for identifying for me the bat; and also to Dr. Elliott Smith who not only called my attention to the paper by Duval and Garnault, but most kindly made for me a manuscript copy of the paper, which I could not otherwise have had an opportunity of seeing.

EXPLANATION OF PLATE.

Reference Letters:—*J.C.*, Jacobson's cartilage; *J.D.*, Jacobson's duct; *J.O.*, Jacobson's organ; *n.s.*, nasal septum; *p.n.*, prenasal; *P.vo.*, prevomer; *S.D.*, Stenson's duct; *S.C.*, Stenson's cartilage; *vv.*, veins.

Figs. 1-3.—Transverse vertical sections through anterior part of Jacobson's organ (× 25).

Figs. 4-5.—Transverse vertical sections through anterior and posterior parts of Jacobson's organ (× 60).

Fig. 6.—Section across posterior part of Jacobson's organ, showing its relations and relative development (× 12).